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Agitating Architecture: Critical Reflections on Ubiquitous Computing

As forms of mobile and embedded digital computing become further integrated into the urban and built environment and everyday spatial practices this would suggest a significant design role for disciplines practiced in the matters of spatial organisation and planning, namely, architecture and urban design. Yet Malcolm McCullough has recently asserted that "Interaction design is the discipline best positioned to affect how [people] deal with technology".[1] With this in mind, and in view of the ever-expanding design and research field allied to the 'ubiquitous computing' (ubicomp) visions advanced by Mark Weiser of the Xerox Palo Alto Research Centre (PARC) in the 1990s, this paper considers the role of disciplinary frameworks in conceptualising emerging technologies in and for the built and urban environment. More specifically, the contention here is that core ubicomp concepts, such as embedding computing into complex everyday physical and social frameworks, and context-awareness, find earlier origins in urban and architectural projects that explored computing and communications technologies as they emerged from military-based research contexts from the 1950s onwards. More specifically this paper discusses ubicomp concepts in relation to Cedric Price's 'Fun Palace' project (1961-65), and the lesser renowned 'Do-It-Yourself-City' project by Fernando Montès and Bernard Tschumi (1970). Revisiting these architecture projects intends to offer a critical perspective on the present ubicomp fervour, as well as its curious disregard within architecture. This intends to foreground the wider potential of engaging emerging technologies for the built and urban environment as modes of social, political, and disciplinary agitation.

Ubiquitous visions

Has architecture progressively conceded the 'digital ground' since the mid-1970s? Has it retreated from technology as Martin Pawley once suggested?[2] And can it now move towards a more productive role in the so-called ubiquitous computing era, or, as Malcolm McCullough suggests, are computer scientists and interaction designers those "best positioned" to affect how people deal with contemporary technology?[3] These questions raise larger considerations including the definitions and distinctions of technology, assumptions about its 'proper' role, and how it can be conceptualised across different disciplinary contexts as well as periods of time. With this in mind, this paper intends to explore core concepts of the ubiquitous computing (ubicomp) vision, as advanced by computer scientist Mark Weiser of the Xerox Palo Alto Research Centre (PARC) in the 1990s, in relation to projects by an earlier generation of architects who explored nascent computing and communications technologies as they transitioned from military-based contexts to the consumer milieu of the 1960s; from technologies of production, to technologies of consumption.

Broadly defined, the ubicomp paradigm "proposes a digital future in which computation is embedded into the fabric of the world around us".[4] Put another way, ubicomp envisions a variety of ways to extend and distribute computing into physical space, and to weave "networked information technology into the places and activities of daily life".[5] Connecting the concepts of ubicomp with earlier architectural explorations re-frames both fields in a wider arc of thinking technologies for the built and urban environment. Yet the position advanced here is not intended as a revisionist history of ubicomp, but rather asserts that firstly, projects such as Cedric Price's Fun Palace (1961-65), and the lesser renowned 'Do-It-Yourself-City' by Fernando Montès and Bernard Tschumi (1970), reflect similar computing-environment concepts, and secondly, that an exploration of the foundational assumptions of these projects offers potential insight into establishing critical approaches to contemporary digital engagement.

The aforementioned architecture projects are comparable to contemporary ubicomp approaches in the ways they proposed to embed an ensemble of computing and communications technologies into physical contexts. Equally, they share similar conceptual foundations, including the advocacy of a humanist agenda, a focus on social interaction, and exploring the potential for technologies to reconfigure spatial and social organisation through informational systems. Conversely, these architecture projects are considered distinguishable from ubicomp thinking in the ways they engaged computing and communications technologies to, both implicitly and explicitly, challenge, question, and *agitate* their own disciplinary frameworks, as well as broader institutional and socio-political orders – or so they thought.

Etymologically, the term agitation carries several connotations. While in a psychological sense it can describe a sense of unease, annoyance, or nervousness, in the field of physics it refers to the behaviour of particles and the transfer of energy, denoting movement, action, and force. Each of these understandings is considered relevant here. A notion of disciplinary

agitation is highlighted in how the cited projects engaged emerging technologies in ways that challenged conventional understandings of architecture. Furthermore, as each of these projects prioritised attention to conditions of time, movement, interaction, and action, this suggests a more literal interpretation of an agitated architecture.

Similar to ubicomp concepts, Price, and Tschumi and Montès gave focus to exploring the processes and possibilities of socio-spatial interaction through engaging emerging technologies. Through a technologically informed architecture and urbanism they conceptualised dynamic, open-ended, and reconfigurable environments, and thus endorsed an improvisational sense of space. Significantly, they did not propose resolved buildings, but rather spatial and technological frameworks to enable social action and performance. In this way, the utility of technology was extended beyond architectural tectonics to processes of communication and interaction. And despite their immaterial qualities, 'information' and 'information systems' were embraced as new materialities of architecture. In doing so, however, these projects were considered to have relinquished core architectural traditions – or expectations – of defining form, space, and aesthetics. Reflecting on Price's Fun Palace, Mary Lou Lobsinger argued that the project, "patently challenges architecture as shelter, as enclosure or as signifier of social values. Here the concept of architecture as conveyor of symbolic expression has been forfeited".[6] While often viewed as a dematerialised architecture, such projects more accurately represent early proposals to embed computation into the built and urban environment.

Thinking computing for contexts

Over the previous two decades a range of computer science affiliated fields, such as Interaction Design[7] and Urban Informatics[8], have developed an interest in, and brought computational thinking to bear on, the design and performance of the built and urban environment. Such interest has paralleled significant developments in technological infrastructure, and relatedly, changing attitudes towards human-technology relations. Additionally, thinking computing for contexts has opened the computer science field to far wider research considerations, applications, and methods. As Genevieve Bell and Paul Dourish note, unlike many areas of computer science research the ubicomp paradigm differed in three key ways. Firstly, rather than addressing a pre-defined problem ubicomp has been largely predicated on "future envisionment".[9] Secondly, rather than concentrating on discrete technologies ubicomp combines many disparate computational elements. Thirdly, ubicomp purports to re-frame the problem definition as social rather than technical.

The foundational principles of ubicomp are largely attributed to computer scientist Mark Weiser and his Xerox Palo Alto Research Centre (PARC) colleagues. Described in seminal articles published during the late 1980s and 1990s, the ubicomp agenda is widely argued to have catalysed a new generation of thinking technologies for people and the built and urban environment.[10] Early computer design in military and commercial contexts had placed emphasis on processing performance and hardware costs over people's time and ease of use and this computing interface model flowed into early desktop computing design. During

the 1980s, as personal computing (PC) grew, Weiser and his colleagues recognised that computing could be usefully harnessed beyond both the dominant desktop interface and work and commercial applications. Weiser reasoned that computers and computing should – and technically could – be alternatively calibrated to "fit the human environment, instead of forcing humans to enter theirs".[11] Opposing the demand-heavy interface of the PC, ubicomp alternatively proposed to embed computing into 'things' and everyday environments to enable multiple 'context-aware' interfaces to sense, interpret, and respond to user's needs, and thus assist in day-to-day activities. Significantly, a key characteristic of this vision hinged on the concept of 'calm computing', that meant – so the rhetoric goes – effortless, intuitive, and most ideally, imperceptible computing assistance for everyday living.

Agitating architecture

Thinking computing for contexts has arguably also found attention in the built and urban environment disciplines. Much has been written about architecture's dalliance with the emerging computing and communications technologies during the 1960s and 1970s, including notably the survey work of Archigram's own Peter Cook in *Experimental Architecture* (1970), and more recently Simon Sadler's numerous publications.[12] In a historiographical sense computing technologies and architecture are often discussed in the context of so-called radical and avant-garde individuals such as Yona Friedman, Hans Hollein, and Cedric Price, as well as groups such as Archigram, Archizoom, and Superstudio, to name a few.[13] More recently, a number of scholars have also drawn links between contemporary computing and communications technologies and the radical architectural visions of the post-war period, including Martijn de Waal, Mark Shepard, Rowan Wilken and Scott McQuire.[14] While many of these accounts foreground the speculative projects and polemic of Archigram, the focus here is shifted to the cybernetic and computational design approach of Cedric Price's Fun Palace project, and the information communications approach of the lesser known 'Do-It-Yourself-City' (DIYC) project by Fernando Montès and Bernard Tschumi.

Price's body of work more generally, and Montès and Tschumi's DIYC project share contextual, conceptual, and aesthetic similarities with other avant-garde architecture projects of the era. This includes the stylistic space-frame superstructures that came to symbolise a more flexible and adaptable architecture, representational techniques such as collage and montage, and anti-establishment ideologies. Yet seen through a contemporary ubicomp lens, these projects are considered distinguishable from other avant-garde pursuits that similarly embraced emerging technologies. This is discussed here with particular focus on the following concepts: the application of emerging computing and communications systems for contexts, at the scale of a building (the Fun Palace) and at the urban scale (DIYC), responsive environments – or in ubicomp parlance 'context-awareness', and the socio-political objectives of empowerment and emancipation.

Commissioned by Joan Littlewood in 1961, the Fun Palace project was conceived as a multi-purpose, flexible space for cultural and educational pursuits such as music, dancing,

teaching, and drama therapy to be located in East London. Detailed technical resolution of computing and communications strategies set the project apart from the more polemic pursuits of other avant-garde projects of the period. Here, as in future projects, Price's ways of thinking technology operated across a number of levels, conceptually, performatively, and critically. Technologies were not adopted in novel ways, but rather strategically integrated to spatially address political and social objectives. Particularly, Price believed that post-war government bureaucracy had rendered society homogenous in the eyes of the state, stripping individuals of unique distinction. According to Royston Landau, Price took issue with the ways Britain's post-war urban and housing planning strategies had meant, "[p]eople had been reduced to standards, and standards had been further reduced to economics".[15]

Additionally, Price was drawn to the field of cybernetics[16], an emerging branch of general system theory that equally influenced his technological interests as well as his overarching position on the practice of architecture. Cybernetics is often taken to be synonymous with computing technologies yet more accurately it reflects a way of thinking about relational self-regulating systems that embody goals. In general terms, cybernetic theory concerns a method of understanding, and thereby potentially intervening in, the self-regulation of systems, where the communication of information is positioned as a central way in which to both construct and control such systems. The Fun Palace project represents Price's commitment to cybernetic theory and the beginning of his close working relationship with cybernetician Gordon Pask who led the Fun Palace's cybernetics committee.

For the Fun Palace, cybernetic theory provided an approach to conceptualising the environment as a dynamic, self-regulating system with a constantly evolving programme to, purportedly, more efficiently address the changing needs and desires of its users, as well as generate new forms of social interaction. While the project aimed to consign control over the reconfiguration of its spatial elements to its users, notably such 'control' did not simply pertain to the user adjusting mechanical levers. Significantly, conceptually and technically the Fun Palace was conceived of as a 'responsive' environment, whereby an ensemble of sensors, response terminals (screens), and software would work together to accumulate user activity data in order to *anticipate* the user's needs. To realise the goals of an anticipatory environment with adaptable spaces and techno-social interactions, the project combined cybernetic logic with elements of game theory[17] and formulated computational methods (software) that could analyse patterns of behaviour to generate predictive strategies. Technical documentation describes this as the communication of data from response terminals and sensors to an IBM 360-30 where information would be processed to generate the parameters to modify the spatial conditions, such as moving walls and walkways.[18] In ways similar to the core ubicomp concept of context-awareness, the Fun Palace was conceived and designed as an environment infused with an assemblage of computational elements that could 'learn' about its users needs, and, following cybernetic logic, instigate ways to intervene and guide the system towards enhanced (social) performance.

Dourish explains that context-awareness in contemporary ubicomp applications can be understood in two key ways: as geo-located (encoded) digital information that can be

retrieved with a digital device, and, more commonly and relevant here, as to "use context dynamically to tailor the behaviour of the system or its response to patterns of use".[19] The "ability of computers to be perceptive, interpretive and reactive" is described as central to the contemporary ubicomp vision. [20] Like the objectives of the Fun Palace, ubicomp's context-awareness relies on detecting, identifying, and locating people's movement, routines, or actions, with the view to providing beneficial information to assist with their tasks and activities, and to enhance their experience. For Weiser and Seely-Brown, however, context-awareness meant embedding microprocessors into smaller-scale everyday objects and networking them together such that, "clocks … find out the correct time after a power failure, microwave ovens … download new recipes … walls … selectively dampen sounds".[21] Computation in the Fun Palace alternatively operated at an architectural, not object scale, and enhancing the user's experience meant enabling the user to influence the spatial envelope and thus programme to address broader social and political goals.

Published in the 1970 winter edition of *L'Architecture d'aujourd'hui,* the 'Do-It-Yourself-City' (DIYC) by Fernando Montès and Bernard Tschumi presents similar themes of information, communication, flexibility, reconfiguration, indeterminism, and impermanence. Alongside a host of other projects in the journal that explored transportable, mobile, floating, and convertible housing, the DIYC proposed a city-wide information strategy coupled with the concepts of modular and mobile capsules and adjustable structures. The project title alone references Archigram's earlier speculative work including Peter Cook's Plug-In-City (1964) and Dennis Crompton's Computer City (1964) and Walking City (1964). Likewise, the graphic presentation recalls the Archigram-esque aesthetic of montage and collage, and adopts diagrams and schedules similarly seen in Price's work and co-opted from computer science and engineering schematics.

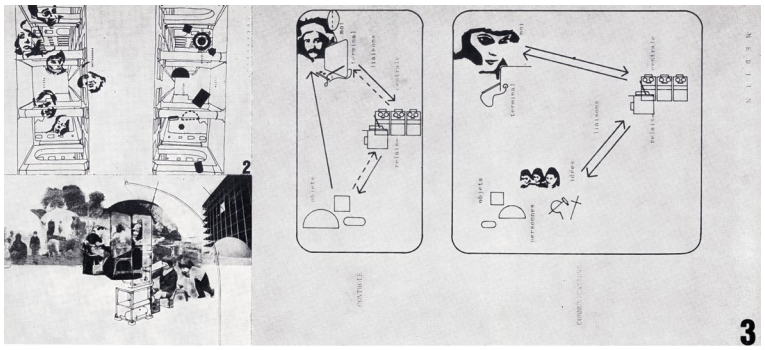

Fig. 1 'Do-It-Yourself-City' (DIYC): *Relay, control, and communications*. Fernando Montès and Bernard Tschumi, *L'Architecture d'aujourd'hui* 148 (February-March 1970): 98. www.larchitecturedaujourdhui.fr.

Notably, the themes of mobility, communication, event, and action, as described in Ron Herron's Instant City (1968-70), for which Gordon Pask was also a systems consultant, are similarly reflected in the DIYC.[22] Yet, if the Instant City was a precedent here, the DIYC adapted certain concepts in a more sobering, and perhaps less supercilious way. Rather than ambitious aims to transpose the metropolis to the outliers the DIYC sought to augment the existing city. Here, the success of future urban life is located in notions of social interaction; the enhancement of *rapport* between people, and people, institutional and state bodies.

Fig. 2 'Do-It-Yourself-City' (DIYC): *Feedback*. Fernando Montès and Bernard Tschumi, *L'Architecture d'aujourd'hui* 148 (February-March 1970): 105. www.larchitectureaujourdhui.fr.

Critically, improving connections between people, ideas, and objects, was seen as a catalyst for action – a way to provoke an event (Figure 1). The project proposed to accelerate such liaisons through the "insertion of new equipment and means of intercommunication within the exist[ing] setting".[23] In ways echoing Price and cybernetic logic, and consistent with the architecture avant-garde movement more generally, the DIYC addressed social processes and libertarian ideals, through a 'kit of parts' approach, modes of flexible spatial organisation, and the integration of computing and communications technologies. Moreover, the project placed emphasis on the role of communication and information to agitate the city's performance in order to better serve the "needs and desires of the citizens".[24] It was envisioned that increased opportunities for communication within the city would accelerate processes of information access, feedback, and response (Figure 2).

While Louis Martin has argued that the DIYC project was "entirely programmatic; form was never an issue",[25] its attention was not wholly immaterial. Despite the emphasis on communications, the project features a series of material components, including, and aligned to the general mobile theme of the journal, mobile and adjustable shelters, capsules and living platforms (Figure 3). Significantly, communication and urban activities are described as

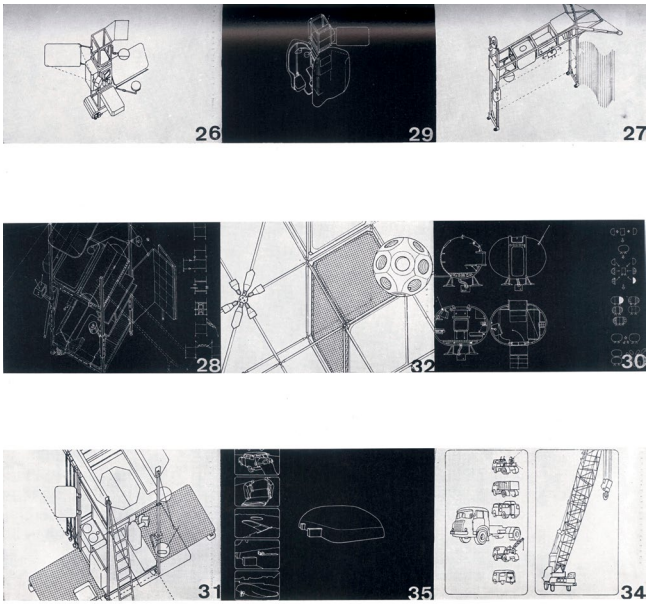

Fig. 3 'Do-It-Yourself-City' (DIYC): *Constituents*. Fernando Montès and Bernard Tschumi, *L'Architecture d'aujourd'hui* 148 (February-March 1970): 103. www.larchitectureaujourdhui.fr.

requiring support from a host of material components in different forms, including screens, “relay terminals”, “communal helmets”, and “machines of learning” (Figure 4).[26] In this way, and similar to Price, the project’s intention was not to actively dematerialise architecture, as the discipline and many critics feared, but rather to imagine forms of architecture that could productively negotiate the terrain between the new material (social) and immaterial (information, communications) forces.

Fig. 4 ‘Do-It-Yourself-City’ (DIYC): *Terminals: Machines of learning*. Fernando Montès and Bernard Tschumi, *L’Architecture d’aujourd’hui* 148 (February-March 1970): 101. www.larchitectureaujourdhui.fr.

Unlike the more abstract speculations that foregrounded computing processes in an image of networking, such as Crompton’s Computer City, the ideas of the DIYC reflect an understanding of the ways the immaterial qualities of networked computing and communications are connected to, and contingent on the lived space of the physical world. As the DIYC functioned as a framework for action, not the action itself, it located agency in the space *in-between* the material and immaterial. Furthermore, the emphasis on a dynamic space of events, interactions, and action situates the DIYC as an antecedent to Tschumi’s subsequent body of theoretical work.

Architecture’s initial embrace of computing and communications technologies coincided with a period of rapid social change and an escalation of political protest. Shifts from Fordist to Post-Fordist modes of production, accelerated levels of mass consumption, global economic re-structuring, and increased mobility, defined the beginnings of late capitalism. Yet as Anthony Vidler notes, this renewed embrace of emerging technologies also coincided with a time when the architectural discipline itself became “a subject of interest from outside” and, “an object of inquiry as an ideology”.[27] Price was critical of the doggedly bureaucratic post-war approaches to urban planning and social housing projects, but he was also critical of architecture’s capacity to respond to such issues and of the discipline’s emphasis on architecture-as-artefact and proclivity for regarding itself as the arbiter of culture. While he expressed these criticisms openly, he also addressed these concerns through his architectural projects.

The architectural embodiment of social and political views is similarly evident in the ways the DIYC addressed the sentiment of protestors in Paris of May 1968, and particularly those connected to the *Unite Pedagagique* groups from the Ecole des Beaux Arts. In title, tone, and intent, the DIYC text echoes the protester’s aims to “return to the people the power of decision

and the right to manage their own affairs".[28] The protests clearly expressed scepticism regarding the social efficacy of institutions, denouncing planning and design methods as "merely instruments of alienation in the hands of the ruling class" – the bourgeoisie, and instead advocated for the restoration of power to people to "design, construct, control and manage" their own environment.[29] Furthermore they placed emphasis on alternate modes of communication to "disseminate the truth about the built environment outside of the corrupt channels of the bourgeois press".[30] In the DIYC computing and communications equipment, together with forms of mobile and demountable architecture became new vehicles for better control and choice. In subsequent publications Tschumi cited the events of 1968 as those that catalysed his radical questioning of the architectural discipline and the definition of its scope.[31]

The projects discussed here connected new technologies to critical design strategies to challenge institutional authorities, and disciplinary orthodoxies, yet these technologically-infused architectural strategies found limited application for a number of reasons. Confidence in computing-environment and information-driven strategies waned as several of Price's projects and city-wide initiatives such as Project Cybersyn in Chile (1972-73)[32] proved problematic to implement technically, economically, and socio-organisationally. Additionally, the origins of cybernetics research had not been easily forgotten, and notions of militarisation and oppression, that were considered antithetical to a societal ethos of decentralisation, choice, and empowerment, continued to plague its application.

By the mid-1970s, technology-led ideas, systems thinking, and pseudo-scientific approaches were in retreat from various shades of criticism. In architecture, information-based approaches were rejected as aggressively "scientistic", [33] and computing assumed a less radical role of optimising extant disciplinary practices. In 1969 George Baird argued that Price's Potteries Thinkbelt project, that expanded on the ideas of the Fun Palace, was "too technical",[34] while Jean Baudrillard regarded such projects as too experimental. Equally, while the newness of computing and communications technologies had meant they were often viewed as neutral instruments operating outside of authoritarian frameworks, commentators such as Lewis Mumford argued they presented the potential for an even more invidious regime of control and suppression.[35]

Much of the criticism directed at architecture's engagement with computing and communications technologies, both then and now, reflects an assumed divide between humans and technology, and natural versus artificial processes. This sets up the conditions to view computing from a substitutionist perspective, where it is assumed that roles, such as critical design thinking, will be wholly abdicated to the computer. Yet, "the technological is not so easily distinguished from the 'human'".[36] To criticise cybernetics and systems approaches as a thoroughly technological way of thinking, or as too scientistic, overlooks the ways their frameworks are constructed through human intentionality. This relies on humans ascribing values to human activities, and what the system might learn is equally based on observable real-time human behaviours and actions. Still, recognising this reveals the fallacy of earlier architectural explorations that positioned computing and communications

technologies in libertarian frameworks: the do-it-yourself approach and people's choice mandate. While they sought social emancipation, and questioned institutional ideologies through the possibilities of decentralised control, access to information, and participatory practices, they were ultimately substituting one mechanism of control for another.

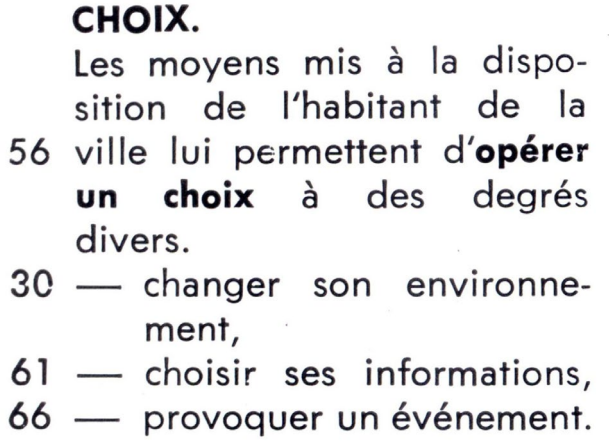
CHOIX.
Les moyens mis à la disposition de l'habitant de la
56 ville lui permettent d'**opérer un choix** à des degrés divers.
30 — changer son environnement,
61 — choisir ses informations,
66 — provoquer un événement.

Fig. 5 'Do-It-Yourself-City' (DIYC): *Choice*. Fernando Montès and Bernard Tschumi, *L'Architecture d'aujourd'hui* 148 (February-March 1970): 103. www.larchitecturedaujourdhui.fr.

More recently, Omar Khan has questioned the efficacy of an architecture that enables people greater control over their environments. He argues Price's approach naively assumed that with such control people would 'do the right thing', and further that "in our contemporary society where corporations are people too and populist sentiments are regularly manipulated to suppress dissent, Price's anticipatory architecture is too easily compromised … He too easily gives up the power of architecture to resist quixotic change in favour of a populist stance to serve people".[37] And it is this guise of choice; the illusory handing-over of the levers of decision-making and control to individuals that, in contemporary ubicomp thinking, requires further critical attention.

While the projects discussed here conceptualised computing in and for the built and urban environment in ways to affect decision-making, control, social organisation, and interaction, their underlying motivations differ from the ubicomp agenda. In the late 1960s, during a period of socio-political unrest, these architects saw new technologies as provocative ways to agitate for institutional change, at both state and disciplinary scales. The ubicomp vision took shape under quite different conditions. Largely driven by technical opportunism, the objective wasn't to radically change or replace existing systems, but, at least initially, to find various ways to – imperceptibly and unobtrusively – weave computing into them, and in this way the ubicomp polemic appeared to accept the status quo.

Nonetheless, ubicomp represents a paradigm shift for computer science itself that has required a significant leap in thinking from the scale and singular interface of a technical object, to the scale and system of the built and urban environment, modes of thinking more familiar to architects and urban designers. For various reasons, including the nascent state of technological infrastructure in the 1960s, but also a general social and cultural un-readiness

for such applications, Price and Montès and Tschumi's conceptualisation of architectural and urban issues in informational and computational terms did not instigate a significant paradigm shift in architecture. Yet while the disciplinary boundaries may not have been so easily agitated then, much remains to be gained from re-exploring their pliability now.

1 Malcolm McCullough, *Ambient Commons: Attention in the Age of Embodied Interaction* (Cambridge, Mass.: MIT Press, 2013), 13.
2 Martin Pawley, "We shall not Bulldoze Westminster Abbey: Archigram and the Retreat from Technology," *Oppositions* 7 (Winter 1976-77): 25-36.
3 McCullough, *Ambient Commons*, 13.
4 Paul Dourish, "What we talk about when we talk about context," *Personal and Ubiquitous Computing* 8, no. 1 (2004): 19.
5 Phil Agre, "Changing Places: Contexts of Awareness in Computing," *Human Computer Interaction* 16 (2001): 178.
6 Mary Lou Lobsinger, "Cedric Price: An Architecture of the Performance," *Daidalos* 74 (2000): 24.
7 Bill Moggridge, *Designing Interactions* (Cambridge, Mass.: MIT Press, 2007), 14.
8 Marcus Foth, Jaz Hee-jeong Choi and Christine Satchell, "Urban Informatics," in *Proceedings of the ACM 2011 Conference on Computer Supported Cooperative Work, CSCW* (2011), 1-8.
9 Genevieve Bell and Paul Dourish, "Yesterday's Tomorrows: Notes on Ubiquitous Computing's Dominant Vision," *Personal and Ubiquitous Computing* 11 (2006): 143.
10 Bell and Dourish, "Yesterday's Tomorrows," 133-143.
11 Mark Weiser, "The Computer for the 21st Century," *Scientific American* 265, no. 3 (1991): 94-104.
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13 Publications such as Dominique Roulliard, *Superarchitecture* (Paris: Editions de la Villette, 2004) and Tahl Kaminer, *Architecture, Crisis and Resuscitation: The Reproduction of Post-Fordism in Late-Twentieth-Century Architecture* (Abingdon, Oxon: Routledge, 2011) address the social, political and economic conditions of the 1960s and 1970s.
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17 Game theory is a way to "model[] the dynamic behaviour of complex social and economic systems," see Stanley Mathews, "The Fun Palace as Virtual Architecture," *Journal of Architectural Education* 59, no. 3 (2006): 42.
18 Mathews, "The Fun Palace as Virtual Architecture," 39-48.
19 Dourish, "What we talk about when we talk about context," 20.

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34 Baird, "La Dimension Amoureuse in Architecture," 41.
35 Lewis Mumford, "Authoritarian and Democratic Technics," *Technology and Culture* 5 no. 1 (Winter 1964): 1-8.
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37 Omar Khan, "Black Boxes: Glimpses at an Autopoietic Architecture," in *Architecture in Formation: On the Nature of Information in Digital Architecture*, ed. Pablo Lorenzo-Eiroa and Aaron Sprecher (Abingdon, Oxon: Routledge, 2013), 124.